Landsat Browse Study

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Browse - What and Why?

- Provide Browse images that can be used for quick and efficient image selection and for visual interpretation

  - Provide full spatial resolution browse for local area evaluation
  - Provide browse that is comparable through time and across sensors
  - Provide browse that is georegistered and GIS-ready
  - Provide “small” browse definition for thumbnails and for quick delivery, particularly for large areas

Browse Usage

- Browse images assist in the selection of remotely sensed data
  - Classic application or why we call them browse
  - GloVis is an example of how browse are used in an image selection client
- Browse images are graphic representations of remotely sensed data that can be used for visual interpretation
  - Serve through web mapping applications
    - Google and similar general visualization web applications
    - Map services for science or education web applications
  - Scientific visual interpretation
  - Education and outreach
- Image selection *and* interpretation needs would be better served with a full-resolution browse

Evolving Trends in Use

- Mainstream applications, such as Google Earth/Map, World Wind, Virtual Earth, and ArcGlobe, are driving user expectations
  - Users expect to see high-resolution images like they see in Google Earth
  - Users expect to overlay maps on imagery
  - Users expect to use mainstream applications to view imagery
- Full resolution browse delivered in standard formats via OGC-compliant services accommodates expectations from this quickly evolving “GeoWeb” community.
- Our core user community is and will continue to be land scientists and managers interested in acquiring remotely-sensed data.
- The source data for browse images will be the georegistered, terrain-corrected and calibrated L1T standard product, or the best possible data if L1T images cannot be created.

Browse Recommendations

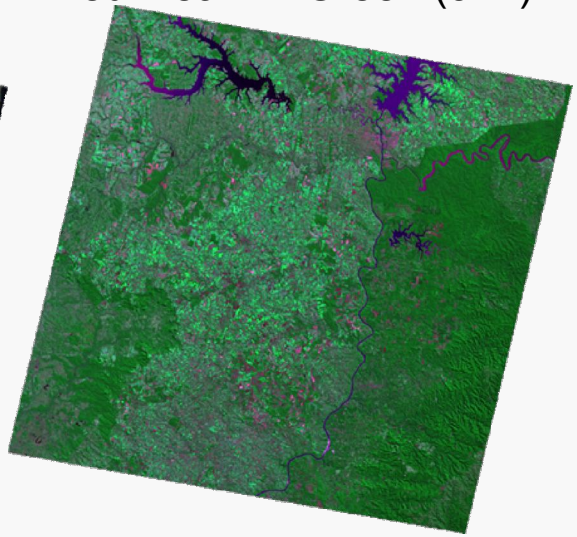
- 24-bit RGB natural color (green vegetation and blue water) band combination that minimizes haze and other atmospheric effects
  - Access to information in a QC band to quantify haze and other atmospheric effects, plus to identify no/bad data areas
- Consistent stretches to permit comparison through time and between images with different atmospheric conditions

Landsat ETM+ band combinations

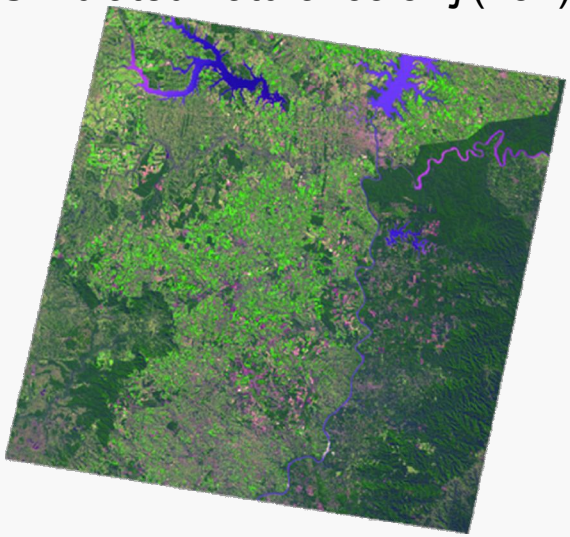
LDCM

True Color (321)

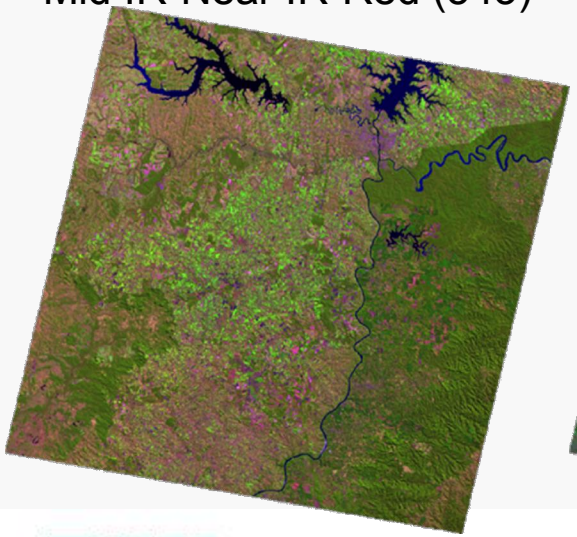
Red-Near IR-Green (342)



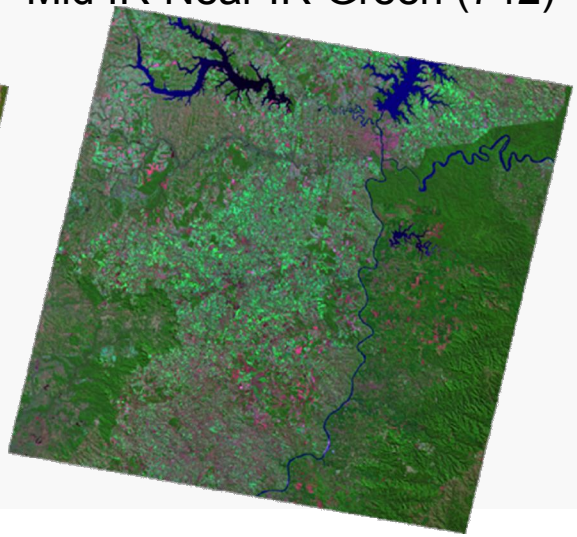
Simulated natural color f(432)



Mid IR-Near IR-Red (543)



Mid IR-Near IR-Green (742)

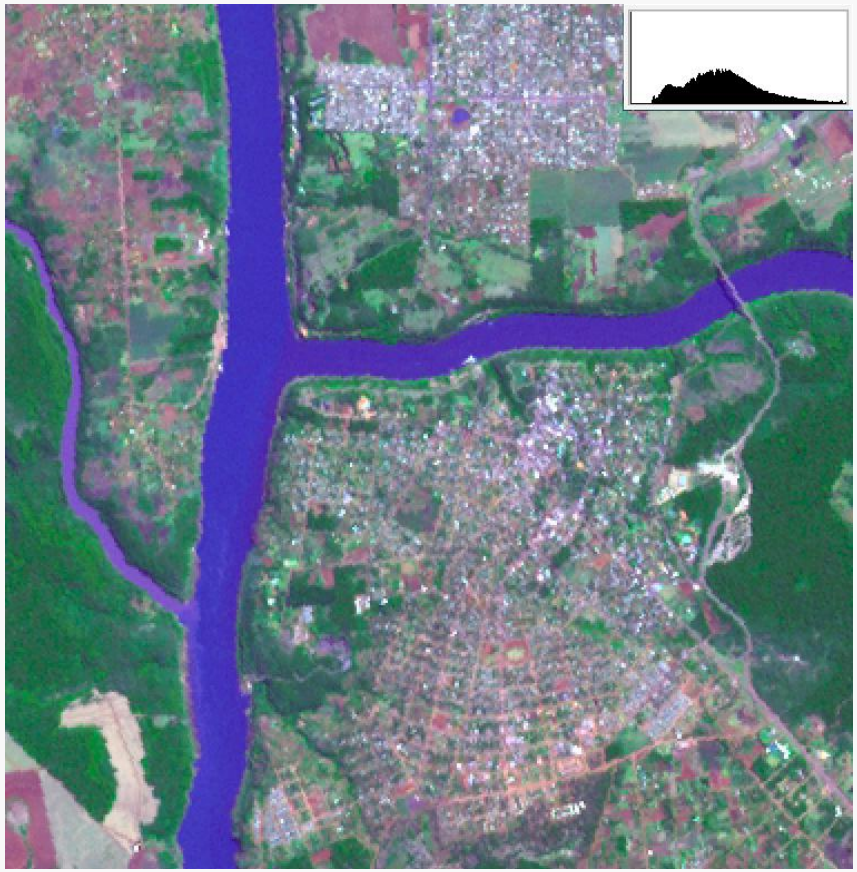


Mid IR-Mid IR-Red (753)

Browse Recommendations

- Formats: compression/transparency alternatives
  - GeoTIFF with JPEG compression
  - JPEG2000 (future consideration for LDCM)
  - PNG – lossless compression
  - JPEG – well supported
  - Archive versus distribution format
  - Transparency
    - not supported in JPEGs
    - not well implemented by OGC-compliant servers
- Georeferencing must be in widely accepted form
  - GeoTIFF with embedded Geographic tags
  - JPEG2000 with embedded GML-style Geographic tags
  - PNG with world file
  - JPEG with world file
  - GeoTIFF or JPEG2000 with embedded Geographic tags and world files

Compression

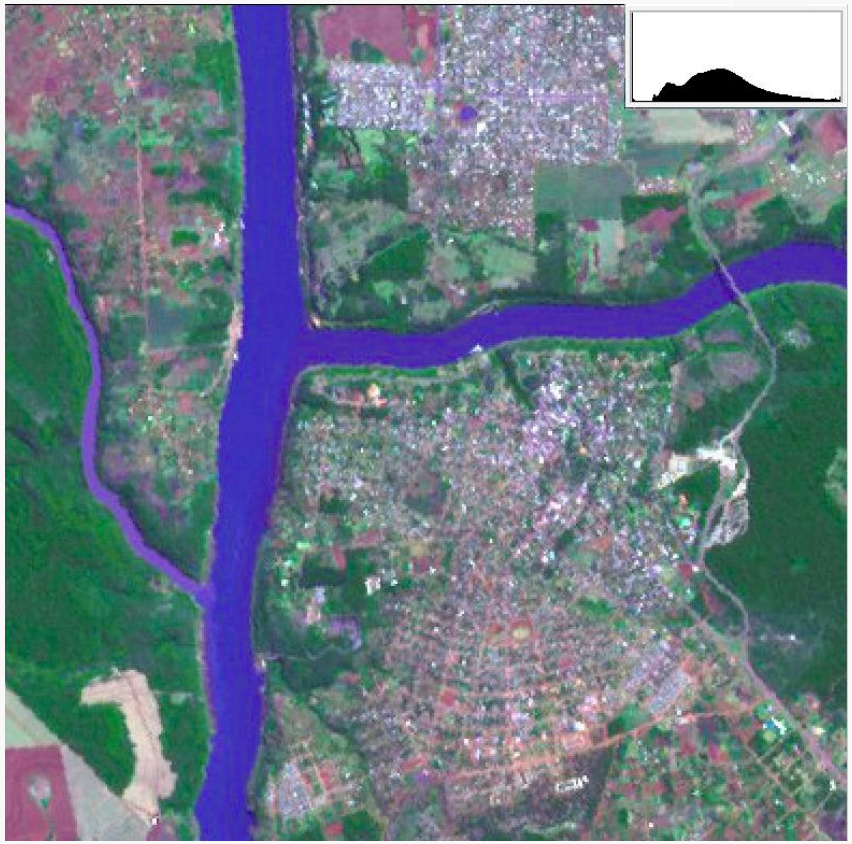


No compression

3 bands - 51.9 MB

JPEG (quality .85)

3 bands - 4.7 MB



Test Suite

Requirements	Criteria	Test suite
1. 24-bit RGB	Achieve balance between distractions caused by artifacts of band combinations and maximum information content.	Band combinations are 321, 543, 742, 753, 342, and simulated natural color
2. Stretches	Define invariant stretch permitting the comparison of images through seasons, years and space.	Linear stretch Linear stretch with 2%clip Linear stretch with gamma approximating vegetation peak
3. Compression	For each format determine compression achieved and display time.	GeoTIFF GeoTIFF with lossless JPEG compression PNG JPEG (quality .5 to 1) JPEG2000
4. Georeferencing	Embedded versus external file	GeoTIFF PNG with world file GeoTIFF with world file

Test sites

Test condition	Criteria	Examples
Vegetated	Natural versus agriculture	Iguazú
Urban	Urban in desert Urban in vegetation	Las Vegas Manaus
Desert	Desert with coastal wetlands Desert with riparian vegetation	UAE Senegal
Snow/ice Clouds/haze	Snow/ice with vegetation Clouds and haze Snow/ice and clouds	Seattle Ghana
Seasonal phenology	Spring, summer, fall, winter	Iguazú Sioux Falls
Turbid water	Spring run-off (Rio Negro versus Rio Solimoes)	Manaus

Usability

- Simplicity – natural color (vegetation - green; water - blue)
- Consistent stretch – browse should be comparable across time, space and sensors
- Fast to download and display
- Widely supported format
- Suitable for visual interpretation